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COMPARISON OF METEOROLOGY ELEMENTS IN ALBERTA ENVIRONMENT'S REGIONAL SCREENING DISPERSION MODELLING DATA SETS

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COMPARISON OF METEOROLOGY ELEMENTS IN ALBERTA ENVIRONMENT'S REGIONAL SCREENING DISPERSION MODELLING DATA SETS

Prepared for

Alberta Environment

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EXECUTIVE SUMMARY

Alberta Environment (AENV) recently established six administrative regions within the province of Alberta. For the purposes of regional representation, one meteorological monitoring station located in each of the six regions was selected. The criteria for selecting the representative regional monitoring stations were based on selection criteria that included: avoiding local obstructions to wind flow; proximity to regional industry; central regional location and typical regional site elevation.

Five years of hourly meteorological data from the six regional monitoring stations were used to prepare screening meteorological data files that can be used by the ISCST3 and CALPUFF dispersion models. This report summarizes the frequency distributions of the wind speed, wind direction, ambient temperature, mixing height, and atmospheric stability class contained within the six regional screening meteorology data sets. The relative distributions of wind speed, ambient temperature, mixing height, and atmospheric stability class for the six regional meteorology data sets are similar, with small variations across the regions. The differing distributions of the wind directions, wind speed, and mixing heights (which are a function of wind speed) are the most prominent differences between regional screening meteorology data sets.

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Meteorology data for the project was purchased from the Climate Services Division of Environment Canada.

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1. INTRODUCTION

Alberta Environment (AENV) recently established six administrative regions in the province of Alberta. These regions (Northwest Boreal, Northeast Boreal, Northern East Slopes, Parkland, Bow, and Prairie) are depicted in Figure 1.1. Conor Pacific Environmental Technologies Inc. (Conor Pacific) was retained by AENV to prepare representative screening meteorological data files based on five years of hourly data for each administrative region. These meteorological data files can be used by the ISCST3 and CALPUFF dispersion models to provide an indication of air quality changes due to changes in source emission scenarios.

This report summarizes and compares the frequency distributions of specific meteorology data elements (wind speed, wind direction, ambient temperature, mixing height, and atmospheric stability class) associated with the regional screening meteorology data sets. In addition, the windroses associated with the five-year regional screening meteorology data sets are compared to windroses based on climatic averages for two addition stations in each administrative region.

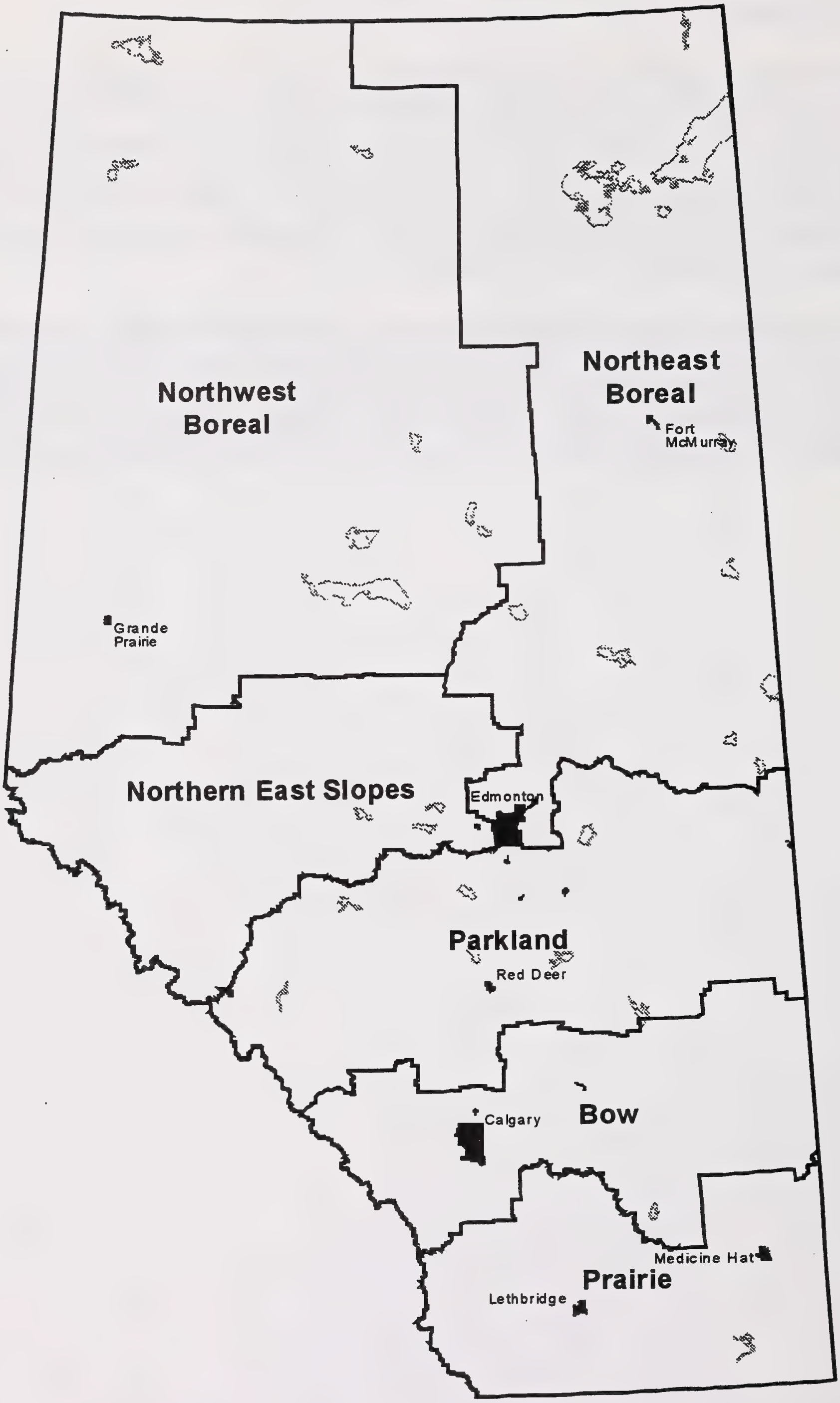


Figure 1.1 Alberta Environment Administrative Regions.

2. COMPARISON OF THE REGIONAL SCREENING METEOROLOGY DATA SETS

Conor Pacific Environmental was retained by AENV to prepare six regional screening meteorology data sets appropriate for use in the ISCST3 and CALPUFF dispersion models. The locations selected for the six regional (see Figure 1.1 for region definition) screening meteorology data sets are as follows:

Region	Location
Northwest Boreal	Peace River
Northeast Boreal	Edmonton Namao
Northern East Slopes	Edson
Parkland	Red Deer
Bow	Calgary
Prairie	Medicine Hat

Five years of raw hourly meteorological data for each location were obtained from the climate services division of the Atmospheric Environment Service (AES) and from the existing meteorological databases at AENV and Conor Pacific Environmental. The six basic meteorology elements required to prepare ISCST3 and CALPUFF dispersion model inputs are:

- Wind Speed
- Wind Direction
- Cloud Amount
- Ceiling Level
- Temperature
- Precipitation Amount.

These raw meteorology data elements are used directly or as a basis to calculate the secondary meteorological parameters required by the dispersion models. The latter include:

- Atmospheric Stability Class
- Mixing Height
- Friction Velocity
- Monin-Obukhov Length Scale
- Surface Roughness.

The terms of reference associated with this project require the six regional screening meteorology data sets to be compared on the basis of wind speed, wind direction, ambient temperature, mixing height, and atmospheric stability class. In the case of wind direction, windroses for the regional representative stations are to be compared to two additional climate stations located within the respective region.

2.1 Wind Speed Comparison

The wind speed data within the regional screening meteorology data sets are essentially the same as the raw wind speed values obtained from AES, except that any wind speeds less than 1.0 m/s (3.6 km/h) are set to 1.0 m/s as per the project terms of reference. The wind speed data from each of the six regional screening meteorological files were analysed to generate the respective frequencies of wind speed in 1 m/s intervals.

Table 2.1 shows the wind speed frequency distribution for each of the six data sets. The most frequent wind speeds are less than 1 m/s. This is especially evident for Edson where over 64% of the wind speed values are less than 1 m/s. All of the stations had wind speeds in the 2 to 3 m/s range larger than the 1 to 2 m/s range. In all cases, wind speed bins in excess of 10 m/s have frequencies less than one percent. Calgary had the highest observed wind speeds with 2 values in excess of 20 m/s.

Table 2.2 shows the 5, 10, 25, 50 75, 90, and 95th percentile wind speed values for each regional station. The fifth percentile wind speed values are all 1.0 m/s. Four of the stations indicate a 10 percentile of 1.0 m/s. At Edson the 25 percentile value is 1.0 m/s. The median values range from 1.67 m/s at Edson to 3.61 m/s at Calgary. The 95% values range from 6.11 m/s at Edson to 8.89 m/s at Calgary.

Figure 2.1 shows the joint histogram of wind speeds at the six regional representative sites. This figure graphically depicts the information contained in Table 2.1.

2.2 Wind Direction Comparison

The raw initial wind direction data values obtained from AES are restricted to 10 degree increments (10, 20,30, 40, etc.) and include a zero value for periods with calm winds. Dispersion modelling requires a valid wind direction for every hour of input data. Therefore the calm wind directions were replaced using interpolation and diurnal persistence. Then the wind direction values were converted from the ‘wind direction from’ convention to the ‘wind direction towards’ convention. Finally each wind direction value rounded to 10 degrees was randomized to produce values plus or minus 5 degrees about the ten-degree increment values as per the project terms of reference.

Table 2.3 shows the wind direction frequency distribution for each of the six data sets. The most frequent (> 10%) wind directions are from NE and ENE at Peace River and Medicine Hat, E at Edmonton Namao, ENE to ESE at Edson, N and NNE at Red Deer, and SSE at Calgary.

Table 2.1 Wind speed distribution summary for each AENV Administration Region.

Wind Speed Range (m/s)	Station Locations											
	Peace River		Edmonton Namao		Edson		Red Deer		Calgary		Medicine Hat	
	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)
0 to 1	15 518	35.410	12 993	29.648	28 264	64.494	16 987	38.762	13 522	30.855	15 688	35.798
1 to 2	4956	11.309	4239	9.673	3607	8.231	5337	12.178	4162	9.497	3986	9.095
2 to 3	6480	14.786	9771	22.296	5233	11.941	7145	16.304	7979	18.207	5302	12.098
3 to 4	4559	10.403	7063	16.117	2153	4.913	4762	10.866	5715	13.041	4511	10.293
4 to 5	4706	10.738	4081	9.312	2152	4.911	4070	9.287	4100	9.356	5390	12.299
5 to 6	3178	7.252	2471	5.638	946	2.159	2999	6.843	3009	6.866	3071	7.008
6 to 7	3052	6.964	1505	3.434	861	1.965	1857	4.237	2030	4.632	3411	7.783
7 to 8	751	1.714	788	1.798	257	0.586	336	0.767	1216	2.775	906	2.067
8 to 9	330	0.753	444	1.013	175	0.399	186	0.424	791	1.805	561	1.280
9 to 10	210	0.479	228	0.520	128	0.292	95	0.217	554	1.264	543	1.239
10 to 11	42	0.096	135	0.308	25	0.057	25	0.057	313	0.714	179	0.408
11 to 12	35	0.080	62	0.141	19	0.043	16	0.037	204	0.465	164	0.374
12 to 13	5	0.011	24	0.055	2	0.005	7	0.016	98	0.224	38	0.087
13 to 14	1	0.002	13	0.030	1	0.002	1	0.002	45	0.103	32	0.073
14 to 15	1	0.002	4	0.009	1	0.002	1	0.002	49	0.112	27	0.062
15 to 16	0	0.000	2	0.005	0	0.000	0	0.000	20	0.046	11	0.025
16 to 17	0	0.000	0	0.000	0	0.000	0	0.000	3	0.007	1	0.002
17 to 18	0	0.000	0	0.000	0	0.000	0	0.000	8	0.018	3	0.007
18 to 19	0	0.000	1	0.002	0	0.000	0	0.000	3	0.007	0	0.000
19 to 20	0	0.000	0	0.000	0	0.000	0	0.000	1	0.002	0	0.000
>20	0	0.000	0	0.000	0	0.000	0	0.000	2	0.005	0	0.000
TOTALS	43 824	100	43 824	100	43 824	100	43 824	100	43 824	100	43 824	100

Table 2.2 Basic wind speed statistics for wind speeds (m/s) for each AENV Administration Region.

Wind Speed (m/s) Percentile (%)	Peace River	Edmonton Namao	Edson	Red Deer	Calgary	Medicine Hat
Minimum	1.0	1.0	1.0	1.0	1.0	1.0
5%	1.0	1.0	1.0	1.0	1.0	1.0
10%	1.0	1.11	1.0	1.0	1.11	1.0
25%	1.67	1.94	1.0	1.67	1.94	1.67
50%	3.06	3.06	1.67	2.5	3.61	3.06
75%	5.28	4.72	3.06	4.72	5.28	5.28
90%	7.22	6.11	5.28	6.11	7.22	7.22
95%	7.78	7.78	6.11	7.22	8.89	8.33
100%	15.56	19.44	15.56	15.56	22.78	18.06

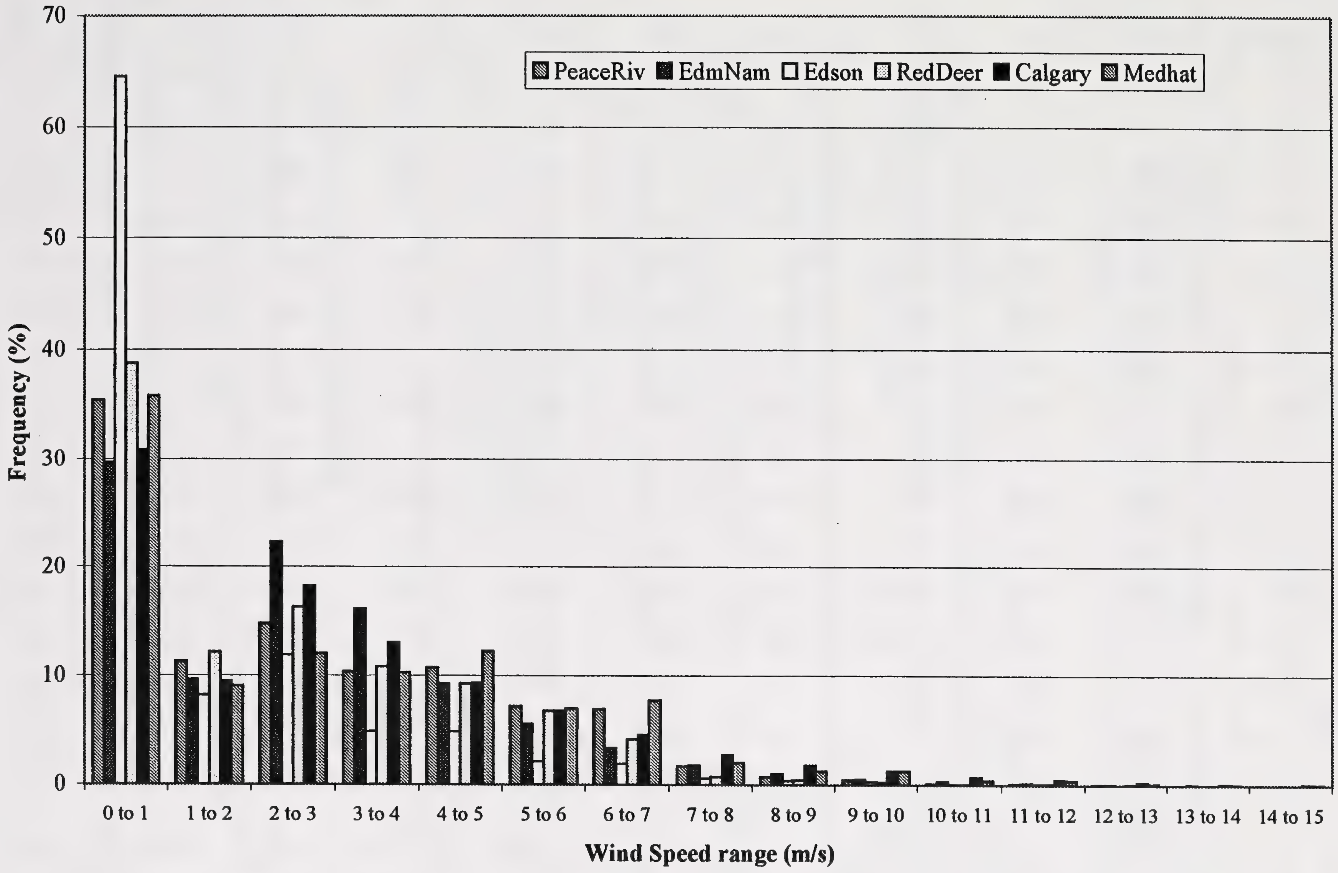


Figure 2.1 Joint histogram of wind speeds at the six regional representative meteorology stations.

Table 2.3 Wind direction distribution summary for each AENV Administration Region.

Wind Direction Towards Sector	Station Locations											
	Peace River		Edmonton Namao		Edson		Red Deer		Calgary		Medicine Hat	
	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)
N	2312	5.276	2723	6.213	333	0.760	5686	12.975	3725	8.500	1706	3.893
NNE	3946	9.004	3103	7.081	775	1.768	5147	11.745	3771	8.605	3813	8.701
NE	5077	11.585	3633	8.290	1489	3.398	2725	6.218	2501	5.707	8970	20.468
ENE	4595	10.485	4045	9.230	6026	13.750	2057	4.694	2048	4.673	5412	12.349
E	4131	9.426	4739	10.814	10 502	23.964	2116	4.828	3326	7.589	3369	7.688
ESE	2256	5.148	4150	9.470	8408	19.186	2609	5.953	1857	4.237	2615	5.967
SE	1772	4.043	3187	7.272	3035	6.925	3146	7.179	3266	7.453	2278	5.198
SSE	2704	6.170	2788	6.362	1300	2.966	3252	7.421	4924	11.236	2112	4.819
S	3788	8.644	1931	4.406	766	1.748	2508	5.723	4105	9.367	1908	4.354
SSW	3670	8.374	1354	3.090	956	2.181	1775	4.050	2035	4.644	2125	4.849
SW	2785	6.355	1197	2.731	2131	4.863	1248	2.848	1552	3.541	1753	4.000
WSW	2040	4.655	1503	3.430	4025	9.184	1299	2.964	1231	2.809	2242	5.116
W	1393	3.179	2035	4.644	2360	5.385	1220	2.784	1464	3.341	2453	5.597
WNW	1085	2.476	2461	5.616	1054	2.405	1640	3.742	1782	4.066	1120	2.556
NW	975	2.225	2373	5.415	406	0.926	3095	7.062	2630	6.001	861	1.965
NNW	1295	2.955	2602	5.937	258	0.589	4301	9.814	3607	8.231	1087	2.480
TOTALS	43 824	100	43 824	100	43 824	100	43 824	100	43 824	100	43 824	100

Windroses were prepared for each of the six regional representative stations, and two other climate stations located within the region. Hence for each region three windroses are provided. The wind direction frequency data for the two additional sites per region was extracted from the Canadian Climate Normals (1951 to 1980), 1982 publication from Environment Canada.

It is important to realize that the windroses depict the distribution of wind direction 'from which the wind is blowing' as is the usual convention for windroses, and that the wind direction data in the regional screening meteorology data sets is wind direction 'toward which the wind is blowing' as per the dispersion model input requirements. These figures allow for an inter-regional wind rose comparison. Figures 2.2 to 2.7 illustrate the regional wind roses and the information shows:

- In the Northwest Boreal region, High Level had a much larger percentage of calm winds (39.7%) than Grande Prairie (9.9%) or Peace River (13.7%). Peace River seems to be somewhat representative of both High Level and Grande Prairie, as the predominant wind directions are north and west. However, it lacks a southeasterly and northwesterly components.

- The Northeast Boreal region wind roses are fairly similar with a westerly and easterly wind direction dominance.

- The predominant wind directions in the Northeast Slopes region are west to northwest, and easterly at Whitecourt.

- The Parkland windroses exhibit high frequencies of wind direction from the south, northwest and southeast.

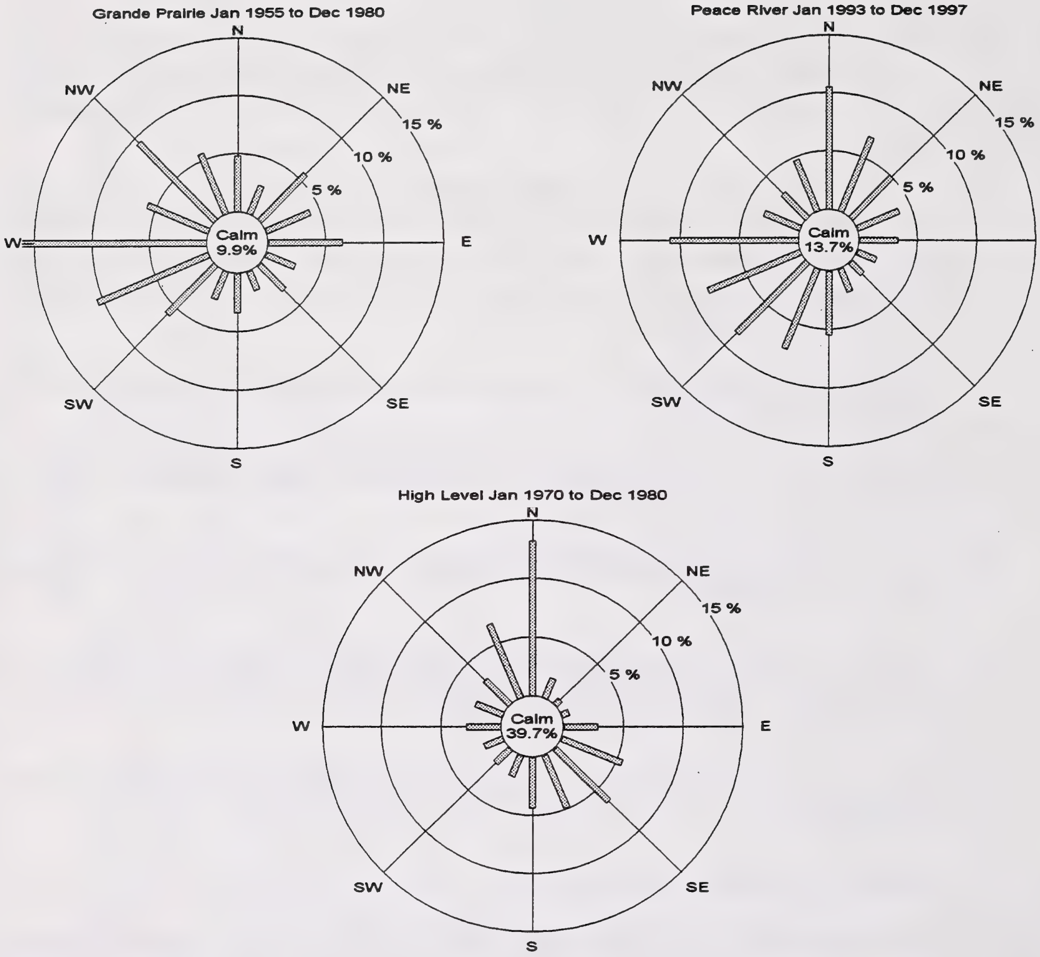
- In the Bow region the Calgary and Suffield wind roses are fairly similar (given that one rose is 8 point and the other 16 point). However the Kananaskis station has a very large frequency of winds from the southwest.

- The Prairie region wind roses are dominated by high frequency winds from the west to southwest.

2.3 Ambient Temperature Comparison

The raw ambient temperature data was in degrees Celsius. This data was converted to degrees Kelvin (which is required by the dispersion models). The six regional screening meteorology data files include hourly ambient temperature data in degrees Kelvin.

Table 2.4 shows the frequency distribution of the respective temperatures in increments of 5 degrees Kelvin. The most frequent (> 10%) temperature ranges are: 270 to 290 K (-3 to 17°C) for Peace River, Edmonton Namao, Red Deer, and Calgary; 265 to 290 K (-8 to 17°C) for Edson; and 270 to 295 K (-3 to 22°C) for Medicine Hat. A total of 23 values below 230 K (-43°C) were observed (12 at Peace River, 9 at Edson, and 2 at Red Deer). Only one value in excess of 310 K (37°C) was observed at Medicine Hat.


Grande Prairie Jan 1955 to Dec 1980

Peace River Jan 1993 to Dec 1997

High Level Jan 1970 to Dec 1980

Figure 2.2 Windroses for monitoring stations in the **Northwest Boreal** region.

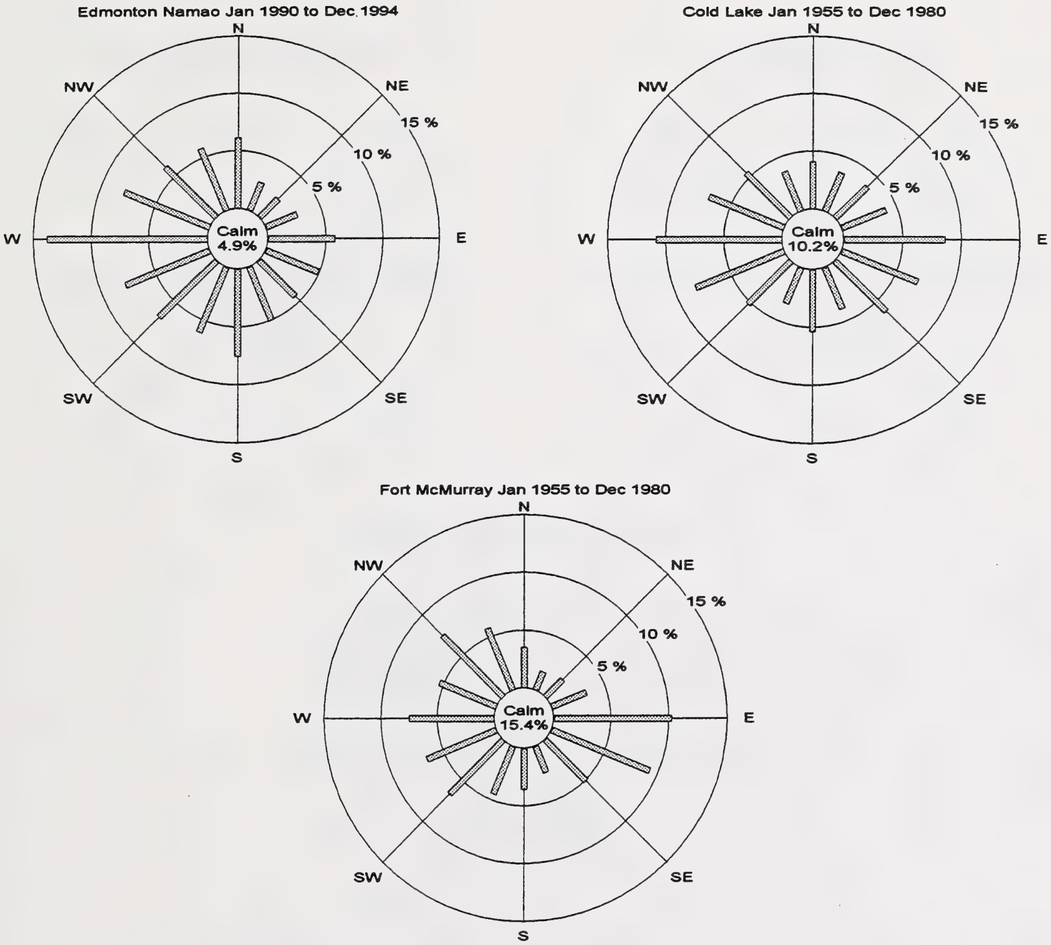


Figure 2.3 Windroses for monitoring stations in the **Northeast Boreal** region.

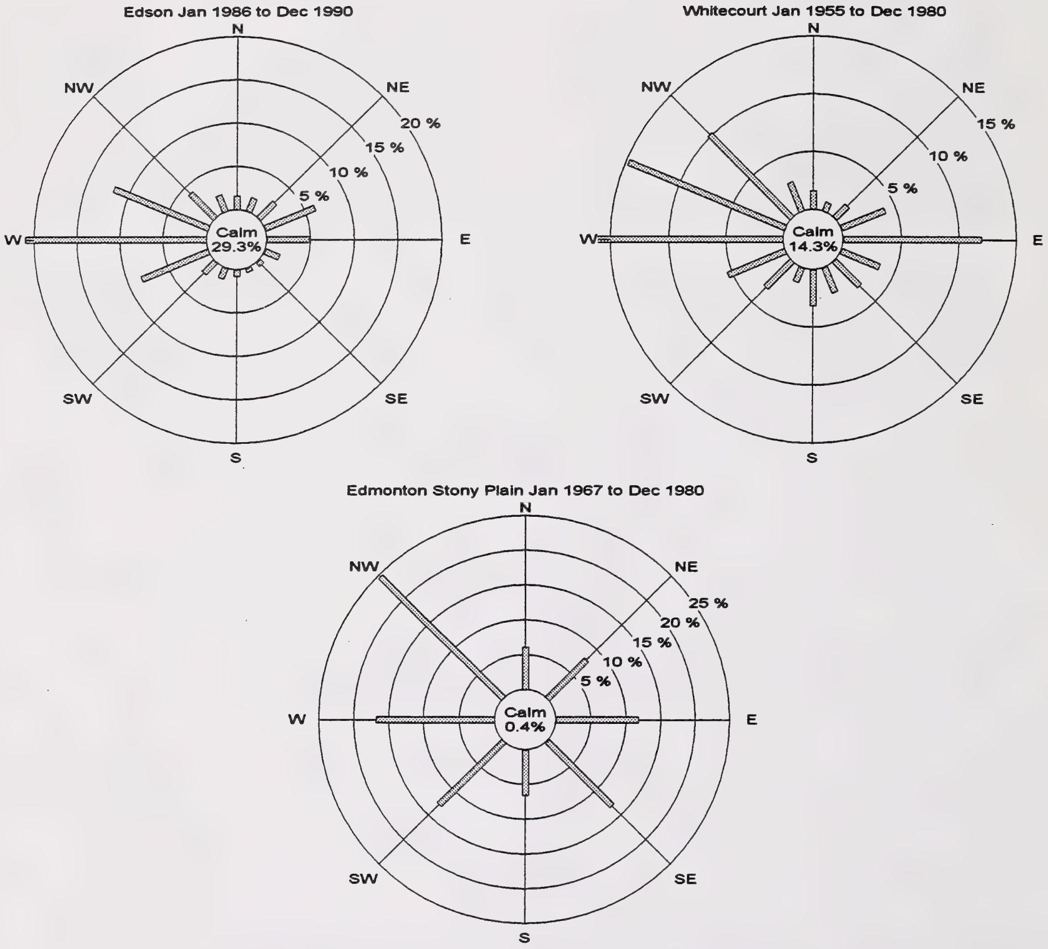


Figure 2.4 Windroses for monitoring stations in the **Northeast Slopes** region.

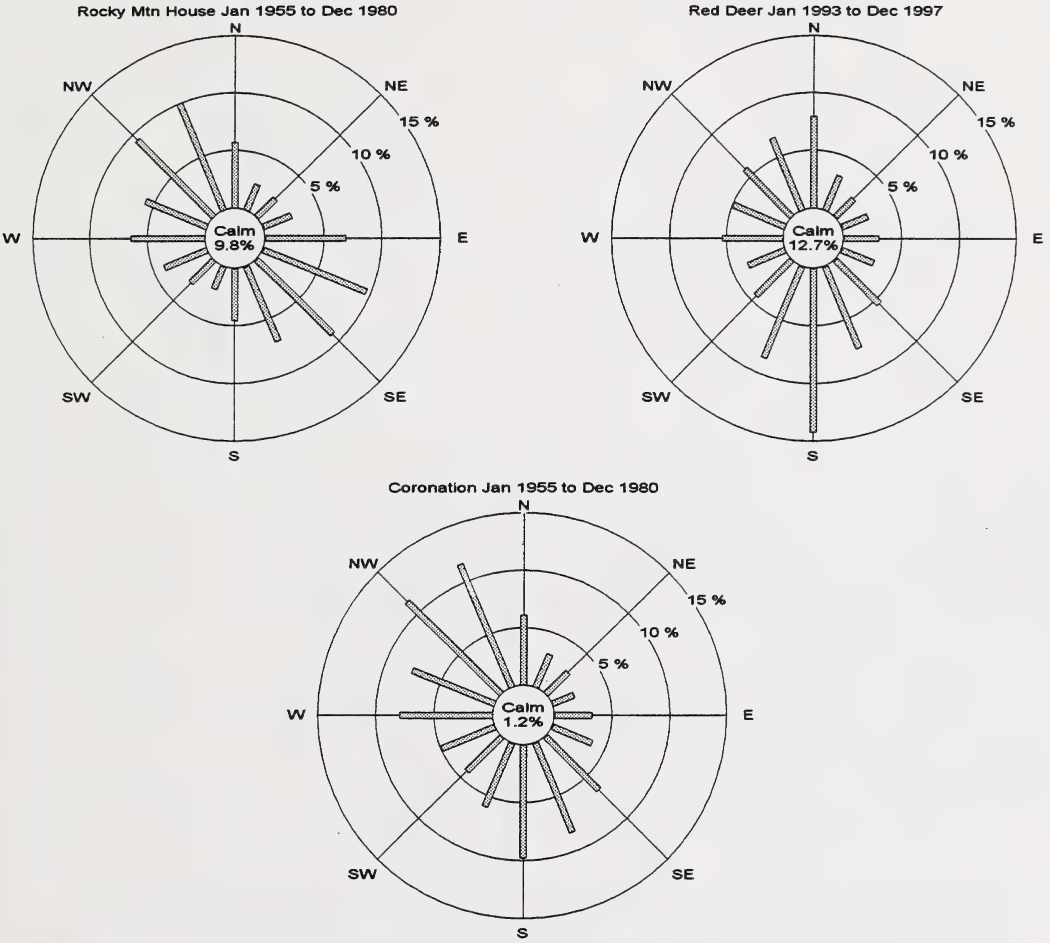
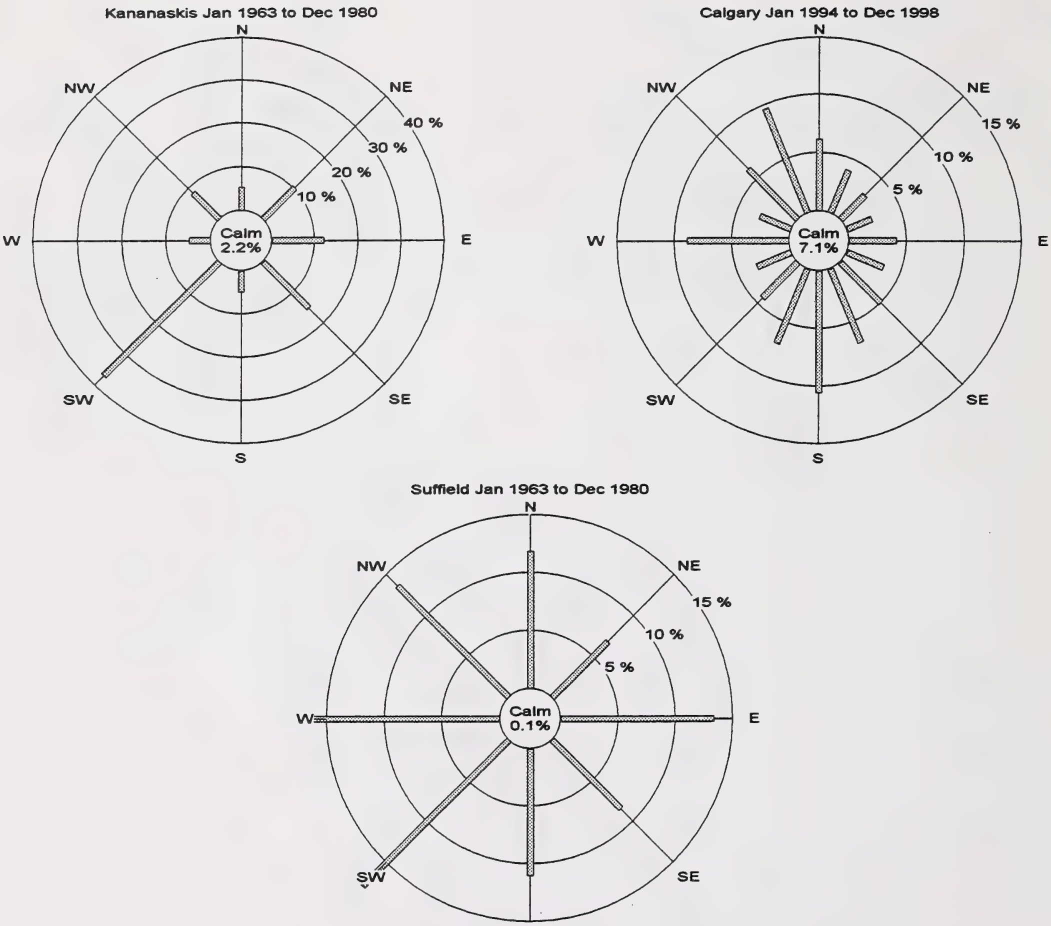


Figure 2.5 Windroses for monitoring stations in the **Parkland** region.

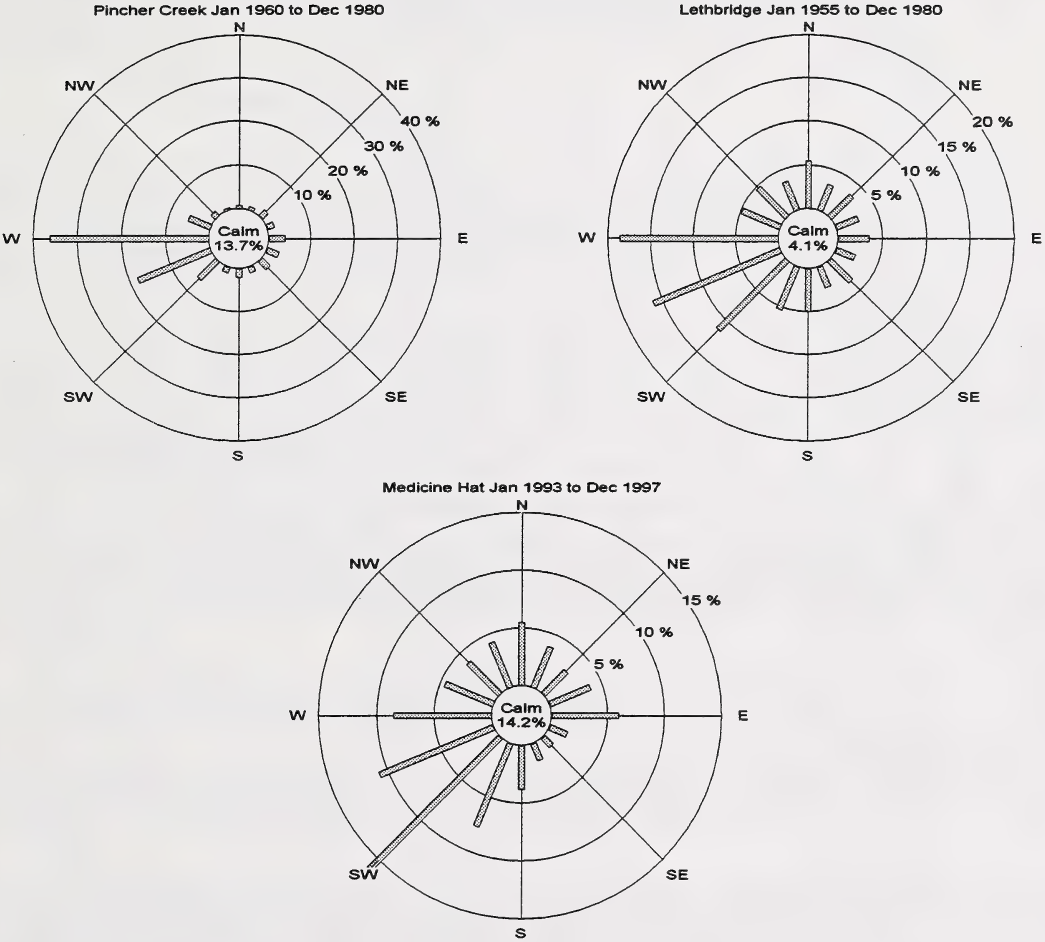


Kananaskis Jan 1963 to Dec 1980

Calgary Jan 1994 to Dec 1998

Suffield Jan 1963 to Dec 1980

Figure 2.6 Windroses for monitoring stations in the **Bow** region.



Pincher Creek Jan 1960 to Dec 1980

Lethbridge Jan 1955 to Dec 1980

Medicine Hat Jan 1993 to Dec 1997

Figure 2.7 Windroses for monitoring stations in the **Prairie** region.

Table 2.4 Ambient temperature distribution summary for each AENV Administration Region.

Ambient Temperature Bin Range		Station Locations											
StartPoint Degrees K	EndPoint Degrees K	Peace River		Edmonton Namao		Edson		Red Deer		Calgary		Medicine Hat	
		Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)
220	225	0	0.000	0	0.00	0	0.000	0	0.000	0	0.000	0	0.000
225	230	12	0.027	0	0.00	9	0.021	2	0.005	0	0.000	0	0.000
230	235	170	0.388	0	0.00	66	0.151	93	0.212	1	0.002	8	0.018
235	240	395	0.901	59	0.13	147	0.335	188	0.429	74	0.169	151	0.345
240	245	759	1.732	385	0.88	316	0.721	498	1.136	326	0.744	467	1.066
245	250	1505	3.434	879	2.01	582	1.328	1038	2.369	773	1.764	741	1.691
250	255	2056	4.691	1353	3.09	1052	2.401	2058	4.696	1523	3.475	1483	3.384
255	260	2866	6.540	1936	4.42	2121	4.840	2455	5.602	1876	4.281	2073	4.730
260	265	3340	7.621	2820	6.43	3096	7.065	3191	7.281	2668	6.088	2291	5.228
265	270	3933	8.975	4222	9.63	5096	11.628	4249	9.696	4153	9.477	3505	7.998
270	275	5505	12.562	6816	15.55	7134	16.279	6230	14.216	6346	14.481	5329	12.160
275	280	5798	13.230	6069	13.85	6753	15.409	6104	13.928	6847	15.624	6556	14.960
280	285	6422	14.654	6501	14.83	7259	16.564	7082	16.160	7402	16.890	6516	14.869
285	290	6131	13.990	6868	15.67	5492	12.532	5732	13.080	5987	13.661	6428	14.668
290	295	3728	8.507	4134	9.43	3303	7.537	3398	7.754	3932	8.972	4408	10.058
295	300	1100	2.510	1552	3.54	1235	2.818	1316	3.003	1544	3.523	2696	6.152
300	305	104	0.237	225	0.51	159	0.363	189	0.431	355	0.810	1010	2.305
305	310	0	0.000	5	0.01	4	0.009	1	0.002	17	0.039	161	0.367
310	315	0	0.000	0	0.00	0	0.000	0	0.000	0	0.000	1	0.002
315	320	0	0.000	0	0.00	0	0.000	0	0.000	0	0.000	0	0.000
TOTALS		43 824	100	43824	100	43 824	100	43 824	100	43 824	100	4 3824	100

Table 2.5 indicates the 5, 10, 25, 50 75, 90, and 95th percentile ambient temperature values for each regional station. Median ambient temperature values range from 276.3 K (3.3°C) at Peace River to 279.5 K (6.5°C) at Medicine Hat. These medians differ by only 3.2 degrees K.

Figures 2.8 to 2.9 show the regional median ambient temperatures as a function of month and hour of day. The hourly figure indicates that the median values exhibit a range of 2.5 degrees K at night and up to 4.0 degrees K during daytime hours. The range of median values as a function of month shows ranges of 10 degrees K in winter and 5 degrees K in summer.

2.4 Mixing Height Comparison

Hourly mixing height values were calculated using the methods outlined in Report 1. The six regional screening meteorology data files include hourly mixing heights in metres. Table 2.6 shows the mixing height frequencies in increments of 200 m. The mixing height ranges that occur most frequently are (> 10%) are: 200 to 800 m for Peace River, Edmonton Namao, Red Deer, and Calgary; 200 to 400 m at Edson; and 200 to 1000 m at Medicine Hat.

Table 2.7 shows the 5, 10, 25, 50 75, 90, and 95th percentile mixing height values for each regional station. Median mixing height values range from 369.7 m at Edson to 676.4 m at Medicine Hat. This represents an 82% difference and indicates the degree of variability in the regional meteorology data files.

Figure 2.10 shows the median mixing height values by region as a function of hour of day. The general shape of the individual curves is very similar. Edson has the lowest overall mixing height values, while Medicine Hat and Calgary have the largest values. The median regional mixing height values show a range of 200 m in the early morning to about 100 m in the mid to late afternoon hours.

2.5 Atmospheric Stability Class Comparison

The six regional screening meteorology data sets include hourly Pasquill-Gifford atmospheric stability class data as integers from 1 to 6 (which is equivalent to the alphabetic representation of A to F).

Table 2.8 shows the frequency of the respective stability class data. The dominant stability class in terms of frequency is D (neutral conditions) for all of the regions. The frequency of the neutral stability class ranges from 31.3% at Edson to 48.0% at Calgary. The most infrequent stability class for all regions is stability class A (very unstable conditions) with the largest frequency of 1.55% at Red Deer. The frequency of the C stability classes (slightly unstable) is always larger than the frequency of the B stability class (moderately unstable). Similarly the frequency of stability class F (very stable) is always greater than E (moderately unstable).

Figure 2.11 shows the histograms of stability class distribution for each of the six regional representative stations. In general the relative stability class distributions are similar.

Table 2.5 Basic ambient temperature statistics for wind speeds (degrees Kelvin) for each AENV Administration Region.

Ambient Temperature (degrees K) Percentile (%)	**Peace River**	**Edmonton Namao**	**Edson**	**Red Deer**	**Calgary**	**Medicine Hat**
Minimum	228.3	236.5	226.5	229.9	234.5	234.3
5%	248.3	253.5	255.1	251.0	253.3	253.3
10%	254.1	259.5	260.3	256.3	259.6	258.9
25%	264.9	269.4	268.8	266.9	269.6	270.4
50%	276.3	277.9	276.8	276.8	278.4	279.5
75%	285.1	286.3	284.5	284.9	285.8	287.9
90%	290.8	291.6	290.4	290.6	291.8	294.4
95%	293.4	294.4	293.4	293.9	294.6	297.8
100%	303.3	306.0	306.1	305.1	306.4	310.5

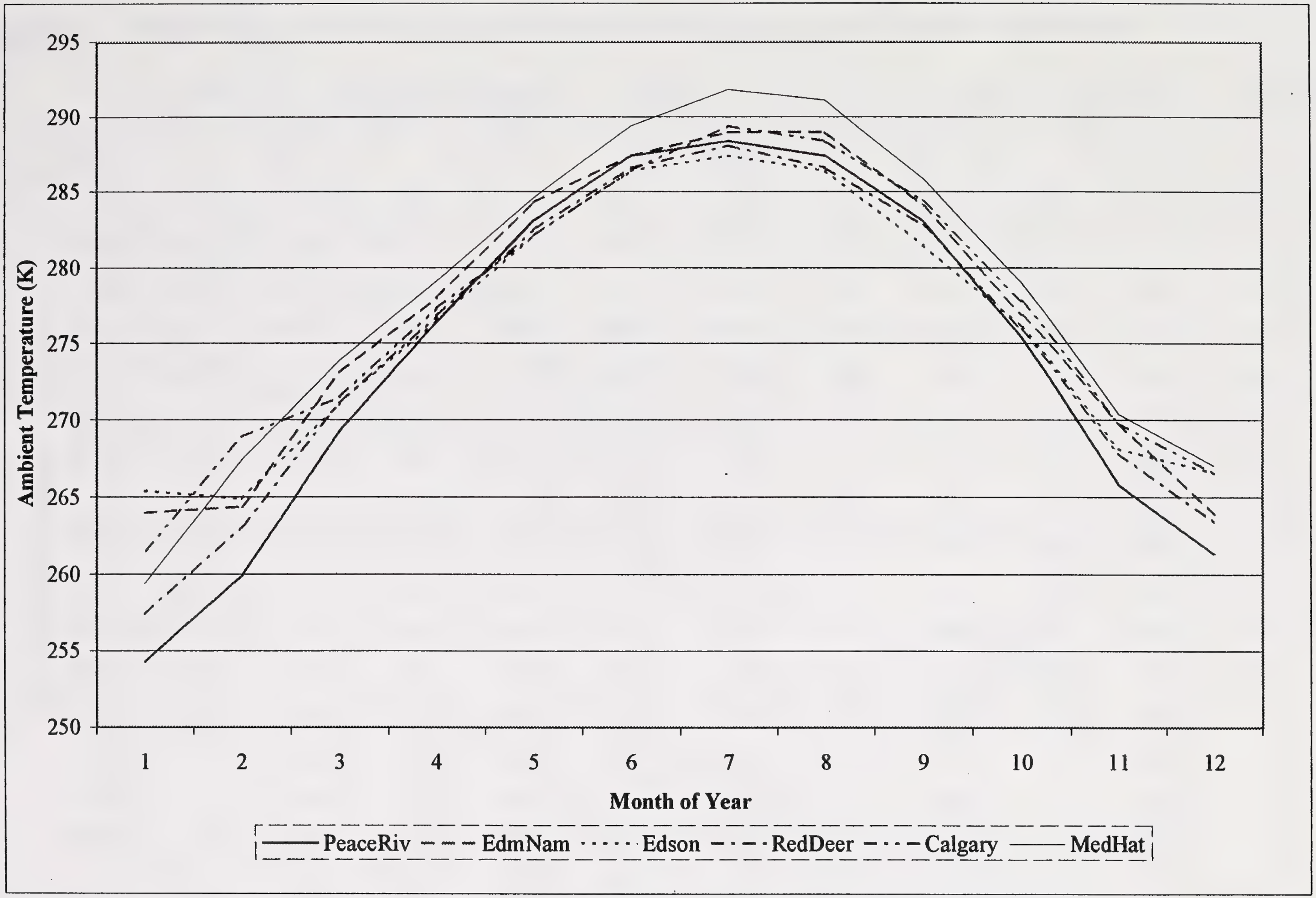


Figure 2.8 Median ambient temperatures for the six regional representative stations as a function of month.

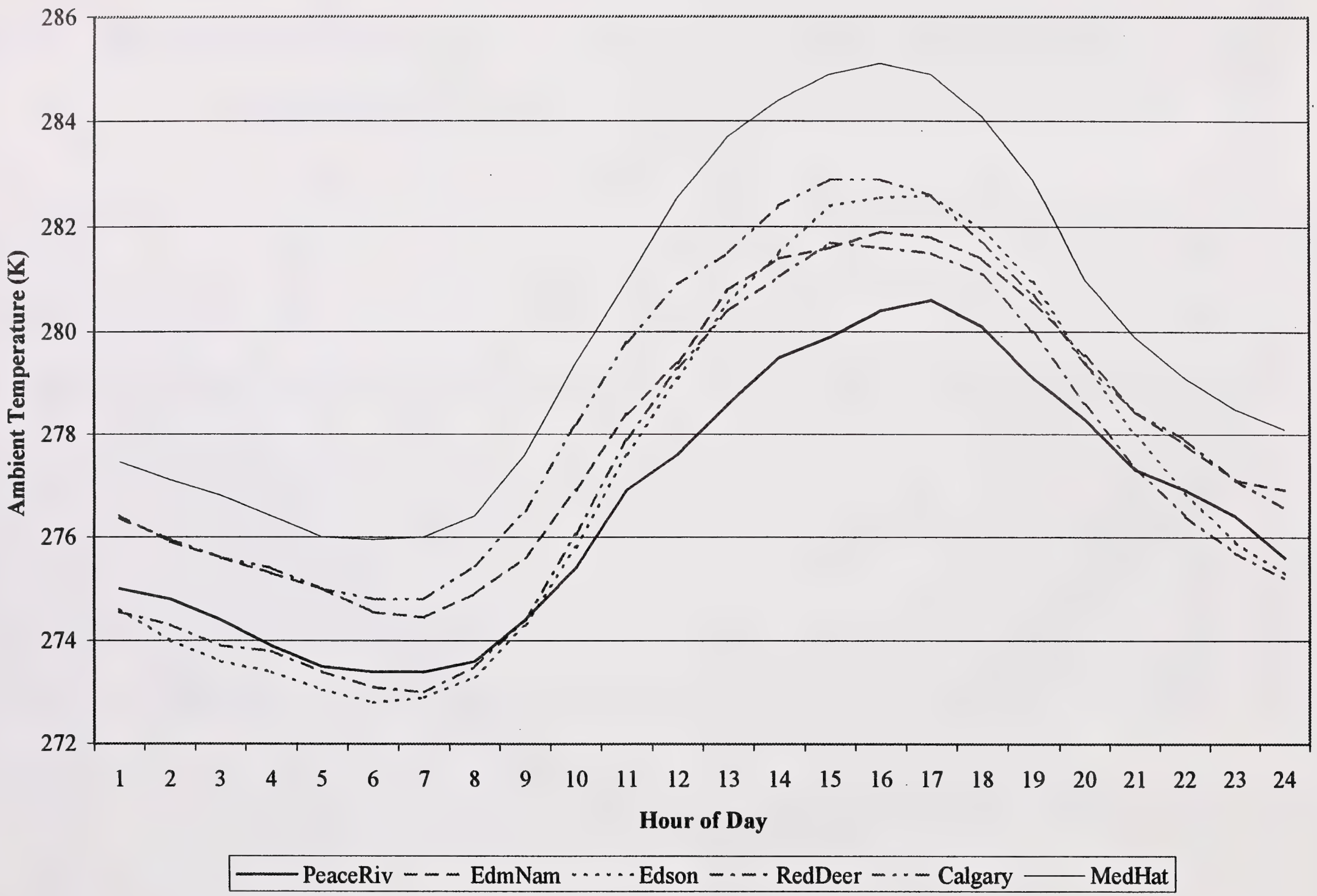


Figure 2.9 Median ambient temperatures for the six regional representative stations as a function of hour of day.

Table 2.6 Mixing height distribution summary for each AENV Administration Region.

Mixing Height Range		Station Locations											
		Peace River		Edmonton Namao		Edson		Red Deer		Calgary		Medicine Hat	
StartPoint (m)	Endpoint (m)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)
0	200	4187	9.554	2543	5.803	17 810	40.640	3317	7.569	1906	4.349	3859	8.806
200	400	10 860	24.781	10 032	22.892	6781	15.473	12 396	28.286	10 087	23.017	9147	20.872
400	600	7235	16.509	9771	22.296	3224	7.357	7771	17.732	8297	18.933	6747	15.396
600	800	5375	12.265	6536	14.914	1968	4.491	5270	12.025	5911	13.488	5452	12.441
800	1000	3780	8.625	3431	7.829	1838	4.194	3723	8.495	4025	9.184	4761	10.864
1000	1200	3208	7.320	2538	5.791	1357	3.096	2785	6.355	3189	7.277	3688	8.415
1200	1400	2216	5.057	2282	5.207	1494	3.409	2111	4.817	2789	6.364	3024	6.900
1400	1600	1654	3.774	1687	3.849	1424	3.249	1588	3.624	2122	4.842	1983	4.525
1600	1800	1238	2.825	1245	2.841	1379	3.147	1157	2.640	1499	3.421	1323	3.019
1800	2000	1201	2.741	1168	2.665	1142	2.606	1120	2.556	1291	2.946	1212	2.766
2000	2200	1460	3.332	1330	3.035	857	1.956	1326	3.026	1385	3.160	1354	3.090
2200	2400	1410	3.217	1261	2.877	834	1.903	1260	2.875	1296	2.957	1266	2.889
2400	2600	0	0.000	0	0.000	761	1.736	0	0.000	18	0.041	7	0.016
2600	2800	0	0.000	0	0.000	1015	2.316	0	0.000	8	0.018	1	0.002
2800	3000	0	0.000	0	0.000	990	2.259	0	0.000	1	0.002	0	0.000
3000	10000	0	0.000	0	0.000	950	2.168	0	0.000	0	0.000	0	0.000
TOTALS		43 824	100	43 824	100	43 824	100	43 824	100	43 824	100	43 824	100

Table 2.7 Basic mixing height statistics for wind speeds (meters) for each AENV Administration Region.

Mixing Height (m) Percentile (%)	Peace River	Edmonton Namao	Edson	Red Deer	Calgary	Medicine Hat
Minimum	143.3	147.9	148.0	150.8	153.0	155.5
5%	159.1	193.8	148.0	184.0	206.6	161.7
10%	207.8	245.5	153.9	226.2	250.4	203.7
25%	318.1	369.8	213.1	321.2	382.5	345.2
50%	597.6	588.6	369.7	544.4	638.0	676.4
75%	1079.8	1041.2	980.35	1019.4	1161.3	1152.3
90%	1752.2	1701.7	1726.9	1687.1	1752.2	1715.1
95%	2087.5	2054.1	2077.2	2054.1	2069.3	2058.8
100%	2396.0	2396.0	2396.0	2396.0	2903.0	2635.7

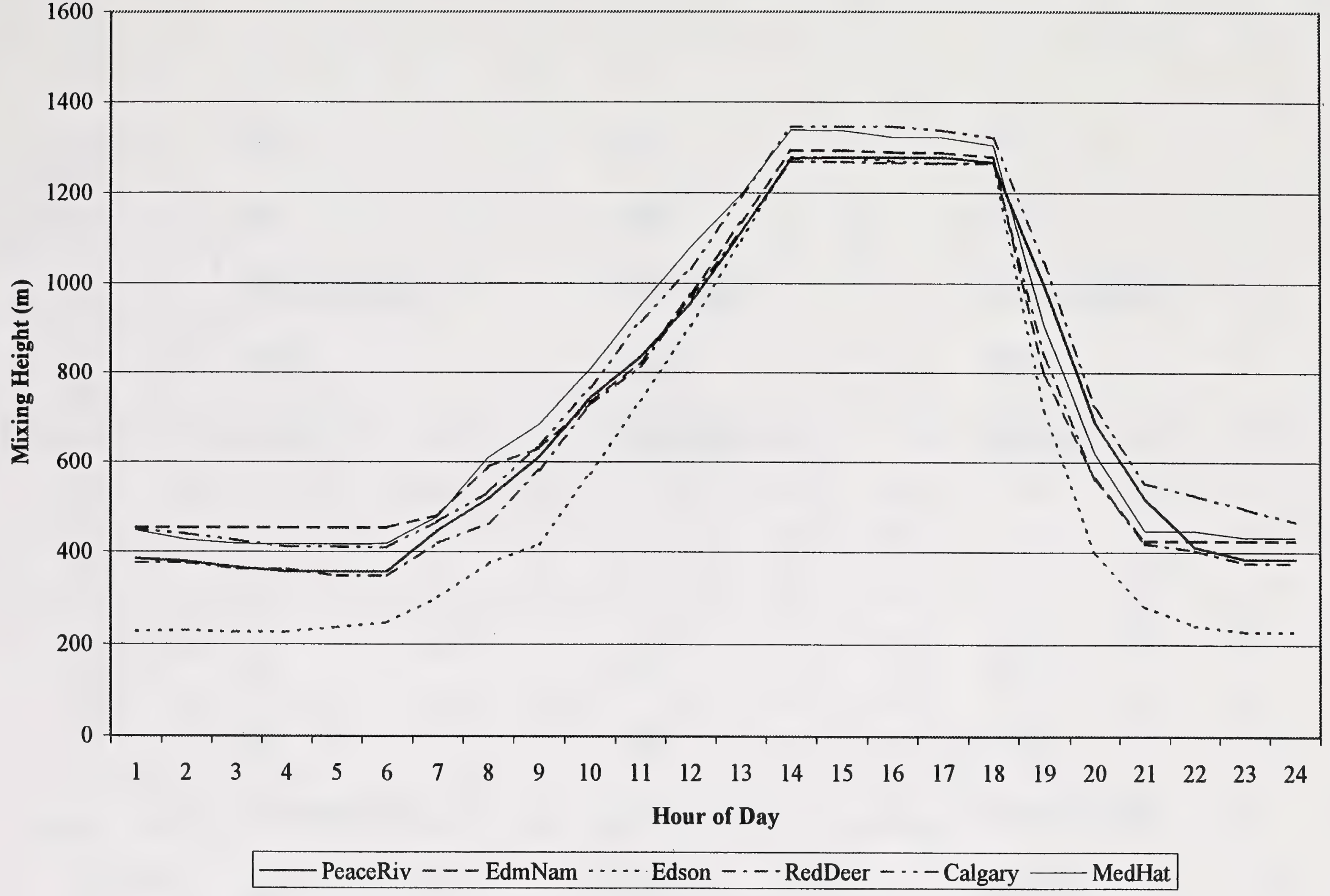
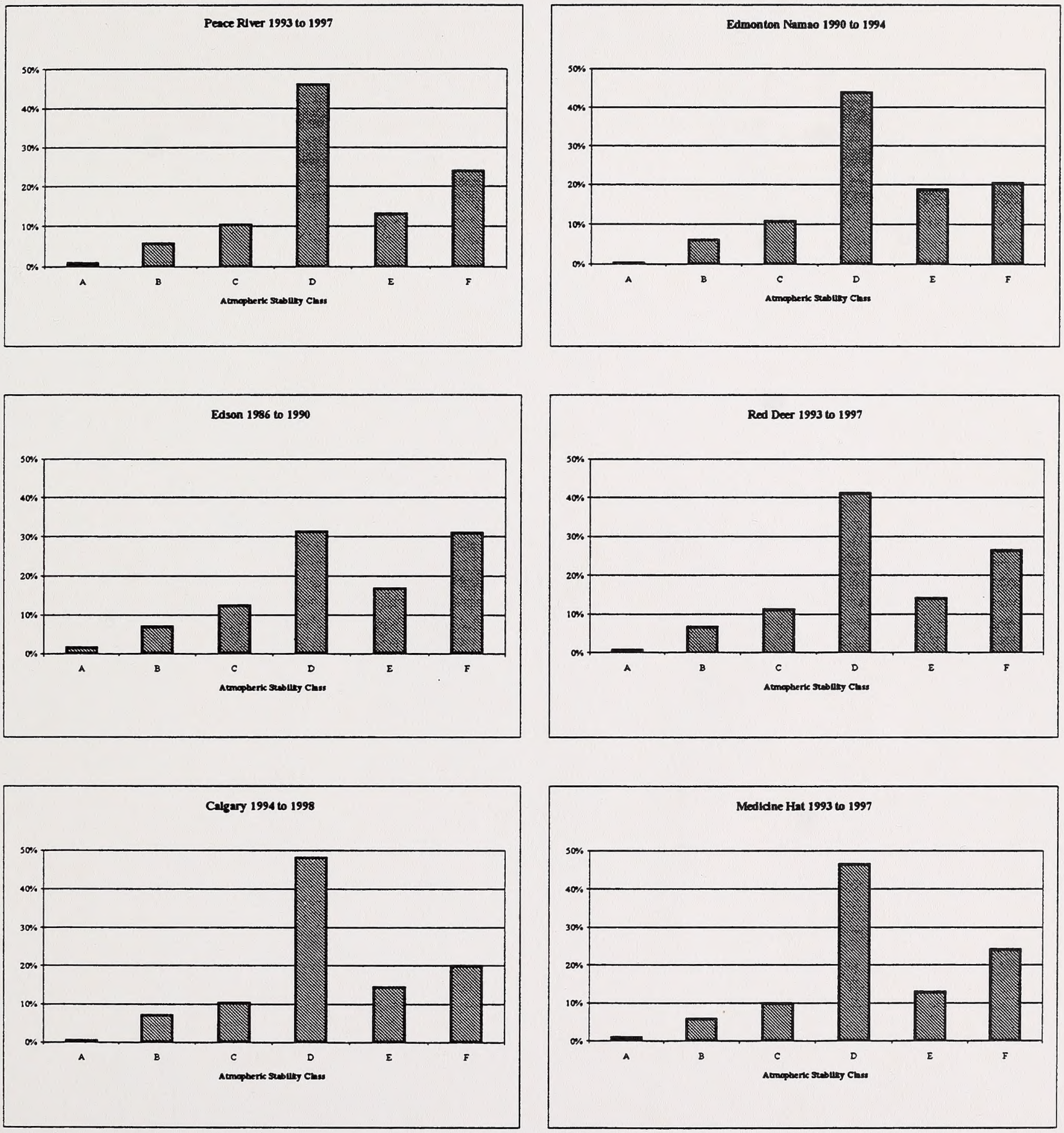


Figure 2.10 Median mixing height values for the six regional representative stations as a function of hour of day.

Table 2.8 Atmospheric stability class summary for each AENV Administration Region.

Letter Stability Class	Station Locations											
	Peace River		Edmonton Namao		Edson		Red Deer		Calgary		Medicine Hat	
	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)	Count	Frequency (%)
A	334	0.762	147	0.335	678	1.547	298	0.680	208	0.475	408	0.931
B	2525	5.762	2685	6.127	3059	6.980	2917	6.656	3047	6.953	2541	5.798
C	4541	10.362	4722	10.775	5412	12.349	4901	11.183	4499	10.266	4353	9.933
D	20 182	46.052	19 219	43.855	13 736	31.344	17 955	40.971	21 045	48.022	20 391	46.529
E	5765	13.155	8175	18.654	7338	16.744	6161	14.059	6274	14.316	5612	12.806
F	10 477	23.907	8876	20.254	13 601	31.036	11 592	26.451	8751	19.969	10 519	24.003
TOTALS	43 824	100	43 824	100	43 824	100	43 824	100	43 824	100	43 824	100


Peace River 1993 to 1997

Edmonton Namao 1990 to 1994

Edson 1986 to 1990

Red Deer 1993 to 1997

Calgary 1994 to 1998

Medicine Hat 1993 to 1997

Figure 2.11 Histograms of atmospheric stability class for the six regional representative stations.

3. REFERENCES

Environment Canada. 1982. Canadian Climate Normals: Volume 5, Wind 1951-1980. A publication of the Canadian Climate Program. UDC: 551.582.2(71).

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